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Magnetocaloric effect in $HoMn_2Si_2$ compound with multiple magnetic phase transitions

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ABSTRACT

The structural, magnetic and magnetocaloric properties of the polycrystalline compound $HoMn_2Si_2$ have been studied. The temperature variation of magnetization and heat capacity show that below room temperature the compound under goes multiple magnetic transitions, at about 80, 15 and 3.5 K respectively. Moreover, the presence of the interesting thermomagnetic irreversibility in $HoMn_2Si_2$ is detected in the magnetization versus temperature plot, which can be ascribed to the narrow domain wall pinning effect. A broad and asymmetric peak is observed for the MCE response which might suggest the underlying first-order nature of the transition and/or the spin fluctuations of the Mn subsystem. The density of states $N(E_F)$ at the Fermi level and the Debye temperature have been determined and analyzed. Large magnetocaloric effect ($\Delta S_M = -9$ J/kg-K for a field change of 5 T around 9 K) suggest that this material is suitable for the low temperature magnetic refrigeration.